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# *RHABDIAS PEARSONI* SP. N. (NEMATODA, RHABDIASIDAE) FROM KEELBACK, *TROPIDONOPHIS MAIRII* (REPTILIA, COLUBRIDAE) IN AUSTRALIA

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***Rhabdias pearsoni* sp. n. (Nematoda, Rhabdiasidae) from keelback, *Tropidonophis mairii* (Reptilia, Colubridae) in Australia. Kuzmin Yu. I., Tkach V. V.** — *Rhabdias pearsoni* Kuzmin et Tkach, sp. n. is described based on specimens found in the lung of the keelback *Tropidonophis mairii* (Gray, 1841) from southern Queensland, Australia. The new species is most similar morphologically to *Rhabdias horigutii* Yamaguti, 1943 and *Rhabdias vibakari* Kuzmin, 1999 with all three species lacking buccal capsule. The new species differs from *R. horigutii* by the smaller circumoral lips and papillae, and shorter tail. *R. pearsoni* sp. n. differs from *R. vibakari* by position of the nerve ring (in *R. vibakari*, it is closer to the anterior end than in the new species) and shorter tail. Australian *R. pearsoni* sp. n. is geographically isolated from *R. horigutii* and *R. vibakari*, both occurring in Eastern Asia.

Key words: Nematoda, Rhabdiasidae, *Rhabdias pearsoni* sp. n., snakes, keelback, *Tropidonophis mairii*, Australia.

***Rhabdias pearsoni* sp. n. (Nematoda, Rhabdiasidae) от килеватого ужа, *Tropidonophis mairii* (Reptilia, Colubridae), из Австралии. Кузьмин Ю. И., Ткач В. В.** — *Rhabdias pearsoni* Kuzmin et Tkach, sp. n. описывается по экземплярам от килеватого ужа, *Tropidonophis mairii* (Gray, 1841), из южного Квинсленда, Австралия. Новый вид морфологически близок к *Rhabdias horigutii* Yamaguti, 1943 и *Rhabdias vibakari* Kuzmin, 1999; у всех трех видов отсутствует ротовая капсула. От *R. horigutii* новый вид отличается меньшими околоротовыми губами и папиллами, более коротким хвостом. *R. pearsoni* sp. n. дифференцируется от *R. vibakari* по положению нервного кольца (у *R. vibakari* оно расположено ближе к головному концу, чем у особей нового вида) и более короткому хвосту. Вид *R. pearsoni* sp. n. из Австралии географически изолирован от *R. horigutii* и *R. vibakari*, которые распространены в Восточной Азии.

Ключевые слова: Nematoda, Rhabdiasidae, *Rhabdias pearsoni* sp. n., змеи, килеватый уж, *Tropidonophis mairii*, Австралия.

## Introduction

Nematodes of the genus *Rhabdias* Stiles et Hassall, 1905 are common globally distributed parasites of amphibians and some squamate reptiles usually found in lungs of their hosts. Ten out of about 60 known *Rhabdias* species parasitize snakes (Baker, 1987; Martinez-Salazar, Leon-Regagnon, 2006). All of them except *R. agkistrodonis* Sharpilo, 1976 are specific parasites of Colubridae. So far, *Rhabdias* spp. were found in snakes from Europe (2 species), Asia (4 species), North and Central America (3 species), and South America (1 species).

Only three *Rhabdias* species were reported from Australia so far, all from amphibian hosts: *R. australensis* Moravec et Sey, 1990, *R. hylae* Johnston et Simpson, 1942 and *R. pseudosphaerocephala* Kuzmin, Tkach et Brooks, 2007, the latter species being a parasite of the cane toad (*Bufo marinus*), an introduced invasive species (Johnston, Simpson, 1942; Moravec, Sey, 1990; Barton, 1994; Dubey, Shine, 2008; our unpublished data). No species of the genus have been found yet in Australian snakes (Pichelin et al., 1999). As part of an examination of samples of *Rhabdias* deposited in the collection of the Queensland

Museum, Brisbane, Australia we have discovered a new species from keelback snake *Tropidonophis mairii* (Gray, 1941). The new species described herein is the first *Rhabdias* from Australian snakes and only the second member of the Rhabdiasidae from Australian reptiles.

**Material and methods**

The lot borrowed from the Queensland Museum (QM) with accession number G207428 contained 37 specimens of rhabdiasid nematodes collected by J. C. Pearson on 21.02.1974 from *Tropidonophis mairii* in Kenmore, Brisbane, Queensland, Australia. They were labelled as *Ophiorhabdias* sp. Nematodes were stored in 70% alcohol. Twenty-one better preserved specimens were measured and defined as the type series. Prior to examination nematodes were cleared in glycerine by gradual evaporation of 10% glycerine-alcohol solution. Figures were made with the aid of drawing tube mounted on Leica DM5000B microscope equipped with DIC optics. Upon examination, the type series and remaining specimens have been returned to the Queensland Museum. New accession numbers are provided in the taxonomic summary.

For comparison with the new species, material on *Rhabdias hotigutii* Yamaguti, 1943 (15 specimens from *Rhabdiophis tigrina*, Primorskiy Kray, Russia) and *R. vibakari* Kuzmin, 1999 (7 specimens including types, from *Amphiesma vibakari*, Primorskiy Kray, Russia) was studied. The comparative material is stored in helminthological collection of the Department of Parasitology, Schmalhausen Institute of Zoology, Kyiv, Ukraine.

## ***Rhabdias pearsoni*** Kuzmin et Tkach, **sp. n.**

Description. (Measurements of holotype in the text, measurements of 20 paratypes in table 1. All measurements in micrometers unless otherwise indicated).

Small nematodes. Body length 2.409 mm. Anterior end truncated, posterior end tapered. Maximum width 106, behind oesophageal-intestinal junction; width at vulva 90. Body cuticle thin, surface finely longitudinally striated. Oral opening wide, round, surrounded with 6 small lips arranged in two lateral groups. Each lip bearing a small sharpened papilla. Buccal capsule absent. Oesophagus club-shaped, 266 long (11.0% of body length), with no prominent dilation in anterior (muscular) part and with elongated posterior bulbus in glandular part. Width at anterior end 25, width of posterior bulbus 37. Nerve ring encircling oesophagus behind its midlength, at 154 from anterior end of oesophagus (57.9% of oesophagus length). Excretory pore behind posterior edge of nerve ring. Excretory duct short, curved ventrally. Excretory glands prominent, approximately of same length as oesophagus, 231 long. Two round coelomocytes situated sub-

**Table 1. Morphometry of *R. pearsoni* sp. n. (20 paratypes)**
**Таблица 1. Морфометрия *R. pearsoni* sp. n. (20 паратипов)**

| Measurements | Mean | Limits | SD | CV, % |
|---|---|---|---|---|
| Body length, mm | 2.409 | 1.859–2.693 | 0.23 | 9.96 |
| Body width at anterior part of intestine | 98 | 78–132 | 12.5 | 12.85 |
| Body width at vulva | 88 | 68–123 | 13.3 | 15.09 |
| Oesophagus length | 249 | 215–264 | 10.8 | 4.33 |
| Oesophagus length, % to body length | 10.9 | 9.4–14.0 | 1.2 | 10.64 |
| Width of oesophagus at anterior end | 23 | 19–26 | 1.9 | 8.30 |
| Width of oesophagus posterior bulb | 38 | 32–40 | 2.1 | 5.63 |
| Anterior end of oesophagus to nerve ring | 141 | 111–156 | 11.1 | 7.90 |
| Anterior end of oesophagus to nerve ring, % to oesophagus length | 56.6 | 49.2–64.2 | 3.6 | 6.36 |
| Excretory glands length | 230 | 182–291 | 28.7 | 12.51 |
| Anterior end to vulva, mm | 1.150 | 0.947–1.353 | 0.11 | 9.58 |
| Anterior end to vulva, % to body length | 49.9 | 43.6–53.2 | 1.9 | 3.87 |
| Tail length | 115 | 97–129 | 8.6 | 7.50 |
| Tail length, % to body length | 5.0 | 4.2–6.2 | 0.5 | 9.79 |
| Number of eggs | 8 | 3–13 | 2.6 | 33.39 |

Notes. SD — standard deviation, CV — coefficient of variation. All measurements in micrometers unless otherwise stated.

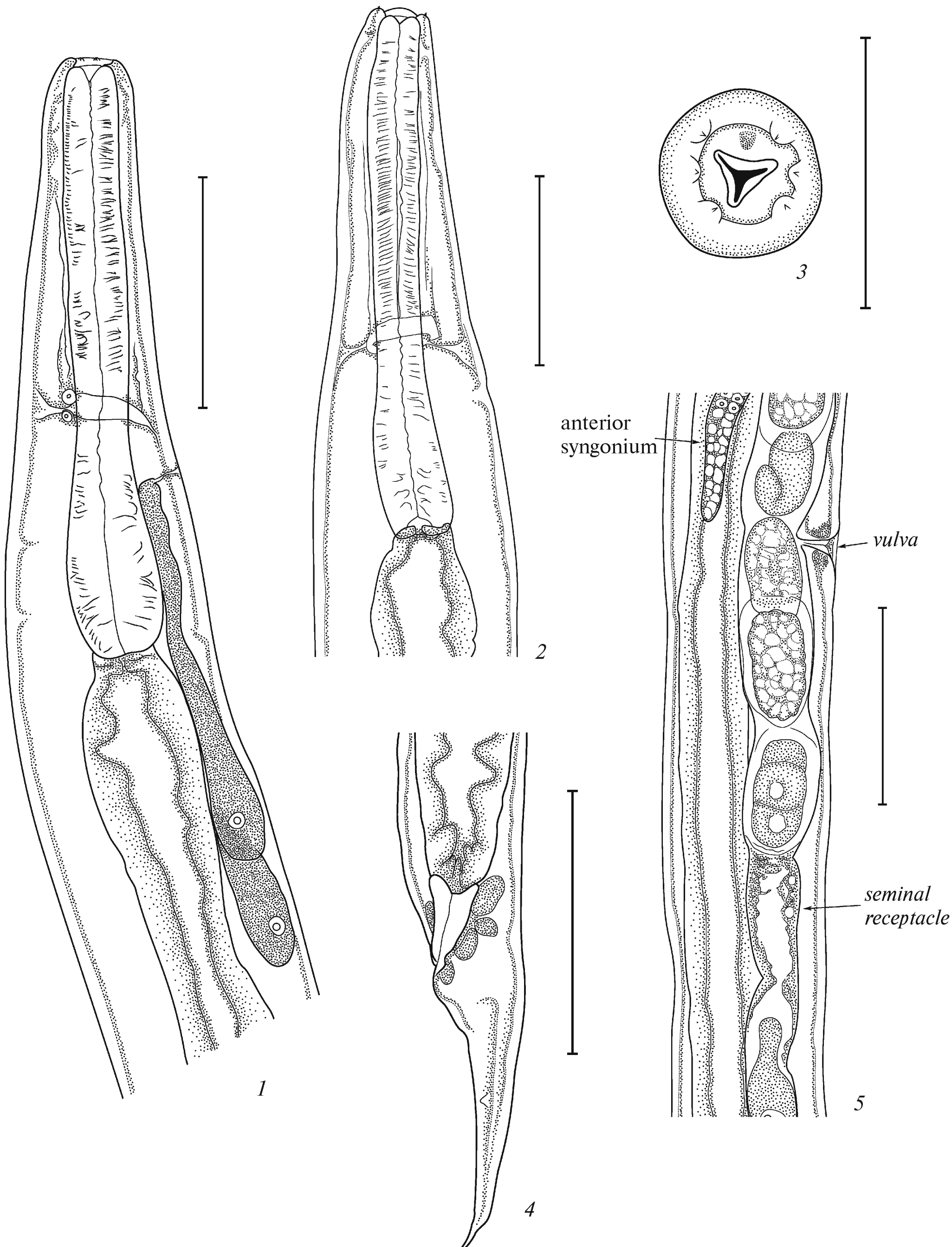



Fig. 1. *Rhabdias pearsoni* sp. n.: *1* — anterior end, lateral view (paratype); *2* — anterior end, dorsoventral view (holotype); *3* — head end, apical view; *4* — tail end, lateral view (holotype); *5* — region of vulva, lateral view (paratype). Scale bars: *1, 2, 4, 5* — 0.1 mm; *3* — 0.05 mm.

Рис. 1. *Rhabdias pearsoni* sp. n.: *1* — передний конец, латерально (паратип); *2* — передний конец, дорсовентрально (голотип); *3* — головной конец, апикально; *4* — хвостовой конец, латерально (голотип); *5* — область вульвы, латерально (паратип). Масштабные линейки: *1, 2, 4, 5* — 0,1 мм; *3* — 0,05 мм.

ventrally between excretory glands and anterior ovary. Single posterior coelomocyte situated behind posterior ovary, on dorsal side. Intestine yellowish, intestine walls thinner in anterior part. Rectum short, sclerotized. Vulva circular, equatorial, at 1.242 mm from anterior end (51.6% of body length). Vulva lips indistinct. Vagina reduced. Uteri joined, amphidelphic, tubular, containing 9 eggs arranged in one row. Embryos at early stages of development. Seminal receptacles straight, elongated, with rough inner surface of wall. Ovaries (syngonia) bending in opposite directions. Proximal ends of ovaries at level of vulva. Tail conical, 115 long (4.8% of body length), gradually tapering, with needle-shaped end. Phasmids minute, situated at midlength of tail.

## Taxonomic summary

Type host. Keelback snake *Tropidonophis mairii* (Gray, 1841) (Reptilia, Serpentes, Colubridae, Natricinae).

Type locality. Kenmore (now a suburb of Brisbane), Queensland, Australia.

Type series. Holotype, 20 paratypes.

Site of infection. Lung.

Prevalence and intensity of infection: one snake was infected with 37 specimens.

Specimens deposited. Holotype: QM G230728, Kenmore, Brisbane, QLD, Australia, 21 Feb 1974, coll. J. C. Pearson; 20 paratypes: QM G230730–230748, same labels; remaining specimens: QM G207428, same label.

Etymology. this species is named after prominent helminthologist Prof. J. C. Pearson (University of Queensland, Brisbane) who collected and deposited the specimens described herein as a new species.

## Remarks

By combination of morphological characters, *Rhabdias pearsoni* sp. n. is related to the species of the genus specific to snakes: *R. agkistrodonis* Sharpilo, 1976, *R. elaphe* Sharpilo, 1976, *R. eustreptos* (McCallum, 1921), *R. fuscovenosa* (Railliet, 1899), *R. horigutii* Yamaguti, 1943, *R. kurilensis* Sharpilo, 1976, *R. lamothei* Martinez-Salazar et Leon-Regagnon, 2006, *R. martinoi* Kurochkin et Gus'kov, 1963, *R. vellardi* Pereira, 1928, *R. vibakari* Kuzmin, 1996. All these species are relatively small and characterized by thin body cuticle, small number of eggs in uteri, club-shaped oesophagus lacking dilation in muscular part, and prominent excretory glands.

Two of the aforementioned species, namely *R. horigutii* and *R. vibakari* lack the buccal capsule which makes them most similar morphologically to the new species. The

**Table 2. Comparison of metrical characters in *R. pearsoni* sp. n., *R. horigutii* and *R. vibakari*. All measurements in micrometers unless otherwise stated**

**Таблица 2. Сравнение размерных признаков *R. pearsoni* sp. n., *R. horigutii* и *R. vibakari***

| Character | *R. pearsoni* sp. n. (21 specimens) | *R. horigutii* (after Yamaguti, 1943) | *R. horigutii* (original data, 15 specimens) | *R. vibakari* (original data, 7 specimens) |
|---|---|---|---|---|
| Body length, mm | 1.9–2.7 | 2.4–4.4 | 4.2–3.8 | 1.7–3.0 |
| Oesophagus length | 215–266 | 280–360 | 299–332 | 207–274 |
| Oesophagus length, % to body length | 9.4–14.0 | ? | 6.7–8.2 | 8.5–14.5 |
| Anterior end of oesophagus to nerve ring | 111–156 | 135–190 | 174–191 | 84–100 |
| Anterior end of oesophagus to nerve ring, % to oesophagus length | 49.2–64.2 | ? | 53.8–62.2 | 30.7–48.2 |
| Distance to vulva, mm | 0.95–13.5 | 1.10–2.15 | 1.7–2.1 | 0.8–1.7 |
| Distance to vulva, % to body length | 43.6–51.2 | 37.0–50.0 | 43.0–48.1 | 39.9–57.5 |
| Tail length | 97–129 | 170–360 | 232–324 | 130–150 |
| Tail length, % to body length | 4.2–6.2 | 5.9–10.0 | 5.9–7.7 | 6.1–8.1 |

new species differs from *R. horigutii* in smaller circumoral lips and papillae (Yamaguti, 1943; Sharpilo, 1976) and shorter tail (table 2). *R. pearsoni* sp. n. differs from *R. vibakari* in position of nerve ring, which in *R. vibakari* is closer to anterior end, than in *R. pearsoni* sp. n. (table 2). Tail in *R. pearsoni* sp. n. is shorter than in *R. vibakari*, both in absolute values and as a ratio to the total body length. Besides, Australian *R. pearsoni* sp. n. is geographically isolated from *R. horigutii* and *R. vibakari*, both occurring in Eastern Asia.

## Discussion

Species of the genus *Rhabdias* are mostly known as parasites of amphibians with relatively few species specific to reptilian hosts. Species of *Rhabdias* parasitizing lizards and chameleons are more morphologically similar to those parasitic in amphibians (Kuzmin, 2003) than to their congeners from snakes. Species from snakes share several characters which distinguish them from other members of the genus, namely the smaller body size, thin, usually smooth or transversely striated body cuticle, relatively short oesophagus lacking the bulbous dilation of muscular part, fewer eggs, and less advanced stage of larval development in laid eggs. Excretory glands in gravid specimens of *Rhabdias* spp. from snakes are usually prominent, whereas in species from other hosts they are indistinct.

On the other hand, high level of morphological uniformity of *Rhabdias* from snakes makes their morphological differentiation difficult. For instance, Goodey (1924) described *R. ophidia* Goodey, 1924 based on position of seminal receptacle which was different from that in closely related *R. fuscovenosa*. Chu (1936) considered this position variable and synonymized *R. ophidia* with *R. fuscovenosa*. He proposed subspecies division within the latter species (*R. f. fuscovenosa*, *R. f. catanensis*, *R. f. brevicauda*) based primarily on differences in tail length. Baker (1978) considered this division unwarranted and suggested that even ratios of certain organs' sizes should not be used for differentiation among nematode species of different body size. On the other hand, some ratios, such as the ratios of tail length or oesophagus length to total body length may be very useful for differentiation of species with similar body length. In the present study, samples of *R. vibakari* and *R. pearsoni* sp. n. appeared to be similar in body length but significantly differed in tail length, both as absolute dimensions and as a ratio to the total body length.

Due to the allometric growth of *Rhabdias* spp. ratios of tail length and oesophagus length to body length vary depending on the size/age of individual nematodes. It has been reported that these ratios are higher in smaller specimens, and vice versa (Baker, 1978; Kuzmin et al., 2003). This allowed us to conclude that *R. pearsoni* sp. n. which has shorter body than *R. horigutii*, significantly differs from the latter species by the tail to body length ratio, which is smaller in the new species (4.2–6.2% in *R. pearsoni* sp. n. vs 5.9–10.0% in *R. horigutii*).

Yamaguti (1943) established the subgenus *Ophiorhabdias* Yamaguti, 1943 for the new species *R. horigutii*, based on the absence of the buccal capsule. The author believed that the buccal capsule was absent in all *Rhabdias* from snakes and thus they should be placed in the subgenus *Ophiorhabdias*, while species from amphibians should remain in the subgenus *Rhabdias*. Sharpilo (1976) raised *Ophiorhabdias* to the generic rank. However, the buccal capsule was later observed in almost all *Rhabdias* spp. from snakes (Sharpilo, 1976; Baker, 1978; Kuzmin et al., 2003; Martinez-Salazar, Leon-Regagnon, 2006). Therefore, lack of buccal capsule was deemed by Baker (1980) unsuitable for distinguishing genera in the Rhabdiasidae; he synonymized *Ophiorhabdias* with *Rhabdias*.

At this point, the lack of buccal capsule was observed in three *Rhabdias* species: *R. horigutii*, *R. vibakari* and *R. pearsoni* sp. n. All of them are parasitic in colubrid

snakes of the subfamily Natricinae: *Rhabdophis tigrina* (Boie, 1826), *Amphiesma vibakari* (Boie, 1826) and *Tropidonophis mairii* (Gray, 1841), correspondingly. The Australasian genus *Tropidonophis* is closely related to the Asian genera *Amphiesma* and *Rhabdophis* (Malnate, Underwood, 1988; Lawson et al., 2005). In our opinion, high morphological similarity between *R. pearsoni* sp. n., *R. horigutii* and *R. vibakari* reflects their common ancestry and coevolution within the same lineage of hosts. The monophyly of this group of species and their relation to other species of *Rhabdias* from snakes and other host groups may be tested by future life cycle and molecular studies.

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